(See appendix table 6-21.) Computer software firms received the most seed money from 1996 to 1998 before relinquishing the top position to Internet companies in 1999 and 2000. Investments in Internet companies represented 60.8 percent of all seed money from venture capital funds in 1999 and 43.7 percent in 2000.

Communications firms gained favor with forward-looking venture capitalists in 2000, attracting 26.2 percent of all seed-stage investments disbursed by venture capital funds that year, up from just 5.0 percent in 1999. The shares of venture capital seed money going to computer software companies fell to 11.3 percent in 1999 and to 10.5 percent in 2000.

With more than 80 percent of seed money going to either Internet, communications, or computer software companies, seed money for companies involved in other technologies declined. Biotechnology, which in 1998 received 11.9 percent of the venture capital disbursed as seed money, saw its share drop to 6.3 percent in 1999 and 0.9 percent in 2000. Medical and health-related firms fared better than biotechnology firms, yet they saw their share drop from 20 percent in both 1997 and 1998 to 6.9 percent in 1999 and 2.9 percent in 2000.

Chapter Summary: Assessment of U.S. Technological Competitiveness

Based on various indicators of technology development and market competitiveness, the United States continues to lead, or to be among the leaders, in all major technology areas. Advances in information technologies (i.e., computers and telecommunications products) continue to influence new technology development and dominate technical exchanges between the United States and its trading partners.

Although economic problems continue to hamper further progress, Asia's status as both a consumer and developer of high-technology products is enhanced by the development taking place in many Asian economies, particularly Taiwan and South Korea. Several smaller European countries also exhibit growing capacities to develop new technologies and to compete in global markets.

The current position of the United States as the world's leading producer of high-technology products reflects its success in both supplying a large domestic market and serving foreign markets. This success in the international marketplace may be the result of a combination of factors: the nation's long commitment to investments in S&T; the scale effects derived from serving a large, demanding domestic market; and the U.S. market's openness to foreign competition. In the years ahead, these same market dynamics may also benefit a more unified Europe and Latin America and a rapidly developing Asia and complement their investments in S&T.

Beyond these challenges, the rapid technological development taking place around the world also offers new opportunities for the U.S. S&T enterprise. For U.S. businesses, rising exports of high-technology products and services to Asia, Europe, and Latin America are already apparent and should grow in the years ahead. The same conditions that create new

business opportunities—the growing global technological capacity and the relaxation of restrictions on international business—can also create new research opportunities. The well-funded institutes and technology-oriented universities that are being established in many technologically emerging areas of the world will advance scientific and technological knowledge and lead to new collaborations between U.S. and foreign researchers.

Selected Bibliography

- Abbott, T.A., III. 1991. "Measuring High Technology Trade: Contrasting International Trade Administration and Bureau of Census Methodologies and Results." *Journal of Economic and Social Measurement* 17: 17–44.
- Abramovitz, M. 1986. "Catching Up, Forging Ahead, and Falling Behind." *Journal of Economic History* 46: 385–406.
- Albert, M.B., D. Avery, F. Narin, and P. McAllister. 1991. "Direct Validation of Citation Counts as Indicators of Industrially Important Patents." *Research Policy* 20: 251–59.
- Bresnahan, Timothy F. 2001. "Prospects for an Information Technology-Led Productivity Surge." Paper presented at the Innovation Policy and the Economy Conference, National Bureau of Economic Research, Washington, DC, April 17, 2001.
- Carayannis, E., S. Kassicieh, and R. Radosevich. 1997. "Financing Technological Entrepreneurship: The Role of Strategic Alliances in Procuring Early Stage Seed Capital." Paper presented at the Portland International Conference on Management of Engineering and Technology, Portland, OR, July 27–31, 1997.
- Carpenter, M.P., F. Narin, and P. Woolf. 1981. "Citation Rates to Technologically Important Patents." World Patent Information: 160–63.
- Chakrabarti, A. 1991. "Competition in High Technology: Analysis of Patents of the United States, Japan, the United Kingdom, France, West Germany and Canada." *IEEE Transactions in Engineering Management* 38 (February): 78–84.
- CHI Research, Inc. 1997. *CHI Research Newsletter* V(1) (March).
- Claus, P., and P.A. Higham. 1982. "Study of Citations Given in Search Reports of International Patent Applications Published Under the Patent Cooperation Treaty." *World Patent Information* 4: 105–109.
- Corporate Technology Information Services, Inc. 1997. *Corporate Technology Directory 1997*. Rev. 12.3. Wellesley Hills, MA.
- Council on Competitiveness. 1996. Endless Frontier, Limited Resources: U.S. R&D Policy for Competitiveness. Washington, DC.
- ——. 1998. Going Global: The New Shape of American Innovation. Washington, DC.
- ——. 1999. The New Challenge to America's Prosperity: Findings from the Innovation Index. Washington, DC.
- ———. 2001. U.S. Competitiveness 2001: Strengths, Vulnerabilities and Long-Term Priorities. Washington, DC.

- European Commission. 1994. The European Report on Science and Technology Indicators 1994. Brussels.
- Faust, K. 1984. "Patent Data as Early Indicators of Technological Position of Competing Industrialized Countries." Paper translated by U.S. Patent and Trademark Office. PTO-1265. Washington, DC.
- Gompers, P., and J. Lerner. 1999. *The Venture Capital Cycle*. Cambridge, MA: MIT Press.
- Greenwald, D., and Associates, eds. 1984. *The Concise McGraw-Hill Dictionary of Modern Economics*, 3rd ed. New York: McGraw-Hill.
- Griliches, Z. 1990. "Patent Statistics as Economic Indicators: A Survey." *Journal of Economic Literature* 28 (December): 1661–707.
- Hatzichronoglou, T. 1996. "Globalization and Competitiveness: Relevant Indicators." Report prepared for the Organisation for Economic Co-operation and Development (OECD). OECD/GD(96)43. Paris: Organisation for Economic Co-operation and Development.
- Kim, L. 1997. Imitation to Innovation: The Dynamics of Korea's Technological Learning. Boston: Harvard Business School Press.
- Kortum, S., and J. Lerner. 2000. "Assessing the Contribution of Venture Capital to Innovation." *RAND Journal of Economics* 31 (4): 674–92.
- Mansfield, E. 1991. "Academic Research and Industrial Innovation." *Research Policy* 20 (1)(February): 1–12.
- Mogee, M.E. 1991. *Technology Policy and Critical Technologies: A Summary of Recent Reports*. Washington, DC: National Academy of Engineering.
- ——. 1993. "International Patent Indicators of U.S. Position in Critical Technologies." Report prepared under NFS Contract No. SRS-9223041. Arlington, VA: National Science Foundation.
- Mogee Research & Analysis Associates. 1997. "SGER: Comparing Assessments of National Position in Key Science & Technology Fields." Report prepared under NSF SGER Grant No. SRS-9618668. Washington, DC: National Science Foundation.
- ——. April 2001. "International Analysis of Human DNA Sequence Patenting." Report prepared under NSF purchase order DOOOO53, Washington, DC: National Science Foundation.
- June 2001. "International Analysis of Internet-Related Business Methods Patenting." Report prepared under NSF purchase order DOOOO53, Washington, DC: National Science Foundation.
- Mowery, D.C. 1998. "The Changing Structure of the US National Innovation System: Implications for International Conflict and Cooperation in R&D Policy." *Research Policy* 27: 639–54.
- Mowery, D.C., and N. Rosenberg. 1993. "The U.S. National Innovation System." In R.R. Nelson, ed., *National Innovation Systems*, pp. 29–75. New York: Oxford University Press.

- Nadiri, I. 1993. "Innovations and Technological Spillovers." NBER Working Paper No. 4423. Boston: National Bureau of Economic Research.
- Narin, F., K. Hamilton, and D. Olivastro. 1997. "The Increasing Linkage Between U.S. Technology and Public Science." *Research Policy* 26: 317-30.
- Narin, F., and D. Olivastro. 1988. "Technology Indicators Based on Patents and Patent Citations." In *Handbook of Quantitative Studies of Science and Technology*. Holland: Elsevier Science Publishers B.V.
- National Academy of Sciences. 1995. The Effects of Technology and Innovation on Firm Performance and Employment. Proceedings of the May 1–2, 1995, conference. Washington, DC.
- National Business Incubation Association. 2001. "Business Incubation Facts." Data retrieved from website http://www.nbia.org/info/fact_sheet.html. Accessed March 21, 2001.
- National Critical Technologies Review Group. 1995. National Critical Technologies Report. Washington, DC. National Research Council. 1995.
- National Research Council, Hamburg Institute for Economic Research, and Kiel Institute for World Economics. 1996. *Conflict and Cooperation in National Competition for High-Technology Industry*. Washington, DC: National Academy Press.
- National Science Board (NSB). 1991. Science & Engineering Indicators—1991. NSB 91-1. Washington, DC: U.S. Government Printing Office.
- 2000. Science & Engineering Indicators—2000. Vol.
 NSB-00-1. Arlington, VA: National Science Foundation.
- National Science Foundation (NSF), Science Resources Studies Division. 1995. *Asia's New High-Tech Competitors*. NSF 95-309. Arlington, VA.
- National Venture Capital Association. 2001. "Venture Capital Fundraising Slows in Fourth Quarter, But Hits New Record for the Year." February 22. Data retrieved from website http://www.nvca.org>.
- Organisation for Economic Co-operation and Development (OECD). 1993. "Technology Diffusion: Tracing the Flows of Embodied R&D in Eight OECD Countries." DSTI/EAS (93) 5 Rev.1. Paris.
- ———. 1995. Purchasing Power Parities and Real Expenditures, 1993; Volume 1, EKS Results. Paris.
- ———. 1996. Structural Analysis Database for Industrial Analysis (STAN). Paris.
- ———. 2000. Analytical Business Enterprise R&D Database (ANBERD). Paris.
- Pavitt, K. 1985. "Patent Statistics as Indicators of Innovative Activities: Possibilities and Problems." *Scientometrics* 7: 77–99
- Pearce, David. 1983. *The Dictionary of Modern Economics*. Cambridge: MIT Press.

- Porter, A.L., and J.D. Roessner. 1991. "Indicators of National Competitiveness in High Technology Industries." Final report to the Science & Engineering Indicators Studies Group, National Science Foundation, two volumes. Atlanta: Georgia Institute of Technology.
- Porter, M. 1990. *The Competitive Advantage of Nations*. New York: Free Press.
- PRS Group. 1999. Political & Economic Forecast Table, "Political Risk Letter," July 1, 1999. Data retrieved from website http://www.prsgroup.com.
- Roessner, J.D., A.L. Porter, N. Newman, and H. Xu. 1997. "1996 Indicators of Technology-Based Competitiveness of Nations, Summary Report." Prepared under NSF Purchase Order No. D22588X-00-0. Atlanta: Georgia Institute of Technology.
- Roessner, J.D., A.L. Porter, and H. Xu. 1992. "National Capacities to Absorb and Institutionalize External Science and Technology." *Technology Analysis & Strategic Management* 4 (2).
- Romer, P.M. 1996. "Why, Indeed in America? Theory, History, and the Origins of Modern Economic Growth." *American Economic Review* 86 (2)(May).
- Scherer, M. 1992. "Research on Patents and the Economy: The State of the Art." Paper presented at the first European Patent Office-IFO Workshop, Munich.
- Souder, W.E. 1995. "The Evolution and Transfer of National Technologies: A Conceptual Model With Comparative Studies." *Journal of Scientific & Industrial Research* 54 (April): 231–42.
- Tassey, G. 2000. R&D and Long-Term Competitiveness: Manufacturing's Central Role in a Knowledge-Based Economy. National Institute of Standards and Technology. Washington, DC: U.S. Department of Commerce.
- ——. 1995. "Technology and Economic Growth: Implications for Federal Policy." NIST Planning Report 95-3. Washington, DC: U.S. Department of Commerce.

- Tyson, L.D. 1992. *Who's Bashing Whom: Trade Conflict in High-Technology Industries*. Washington, DC: Institute for International Economics.
- U.S. Bureau of the Census, Foreign Trade Division. 1999. Data available at http://www.census.gov/foreign-trade. Accessed August 8, 2001.
- U.S. Bureau of Economic Analysis. 2000. Survey of Current Business 80 (10).
- U.S. Bureau of Labor Statistics, Office of Productivity and Technology. 1998. Comparative Real Gross Domestic Product Per Capita and Per Employed Person, Fourteen Countries, 1960–1996. Washington, DC.
- U.S. Department of Commerce. 1995. U.S. Jobs Supported by Goods and Services Exports, 1983–92. Washington, DC.
- U.S. Office of Science and Technology Policy. 1995. National Critical Technologies Report. Washington, DC: National Critical Technologies Panel.
- ——. 1997. Science & Technology Shaping the Twenty-First Century. Washington, DC: Executive Office of the President.
- U.S. Patent and Trademark Office. 1999. *Patenting Trends in the United States, 1963-98*. Washington, DC.
- U.S. Patent and Trademark Office, Office of Information Systems, TAF Program. 1998. "Country Activity Index Report, Corporate Patenting 1997." Prepared for the National Science Foundation. Washington, DC.
- Venture Economics Information Services (VEIS). 1999. *National Venture Capital Association Yearbook, Venture Capital Annual Review*. Newark, NJ.
- WEFA World Industry Service. 2000. Database. Eddystone, PA: WEFA Group.
- World Bank. 1996. World Development Report 1996. New York: Oxford University Press.
- ——. 1999. *World Development Report 1999*. New York: Oxford University Press.
- World Intellectual Property Organization. *Industrial Property Statistics*. Annual series. Geneva.